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OCTOBER 1984 NUMBER 194

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

October 1984 No. 194

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To Our Readers

Nuexco's mailing service made many errors in July and August. We apologize for any inconvenience the mistakes caused. Please contact any Nuexco office if you would like more copies. You can reach our Menlo Park office at (415) 854-1510; Telex: 470674 (NUEXCO UI).

* * *

Included with this Report is a copy of a speech entitled *Uranium Through the Looking Glass*, given by Mr. George White, Jr., President of Nuexco, at the Atomic Industrial Forum's Uranium Seminar in Keystone, Colorado on October 2.

* * *

Also included with this Report is a map to our headquarters in Menlo Park. We welcome customer visits.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

The **Exchange Value** as of September 30, 1984 is **$17.50** per pound U_3O_8, unchanged since last month. The *Current Market Data* section of this Report lists four uranium sales transactions, involving a total of approximately 2,000,000 pounds U_3O_8 *equivalent*. One of those sales involved natural UF_6.

Active supply of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **5,490,000** pounds U_3O_8 or equivalent UF_6, up 435,000 pounds since last month. The corresponding figure for **active demand** is **955,000** pounds, down 95,000 pounds. The spot and near-term **supply-demand ratio** rose to **5.8:1.**

The **Transaction Value** as of September 30, 1984 is **$16.55** per pound U_3O_8, up $0.15 since last month. The current Transaction Value includes 12 transactions involving a total of 4.3 million pounds U_3O_8 or equivalent UF_6 and covers a period of 5 months. Two of the transactions reported this month involved deliveries before 1986, and also met the criteria for inclusion in the current Transaction Value calculation.

The **Loan Use Charge Rate** as of September 30, 1984 is **6 percent** per annum, unchanged since last month, in a nearly dormant market.

* * *

The Exchange Value is unchanged at $17.50; material is still available for sale at or below that level. The sale of small lots of U_3O_8 generally requires buyers to offer prices somewhat lower than $17.00 per pound U_3O_8. Sellers of larger lots of uranium oxides generally can command prices nearer the $17.50 level. The selling of natural UF_6 to a buyer that prefers uranium oxides sometimes requires sellers to discount their offering prices somewhat, primarily by pricing the conversion services contained therein virtually at zero.

The reduced levels of market activity that characterized August increased somewhat during September, but the market was still sluggish, due to several factors.

1. The approach of DOE's October 1 deadline for conversion to the Utility Services enrichment contract (USEC) occupied the attention of many fuel managers who might otherwise have sought to purchase natural uranium.

2. The totals of active spot and near-term uranium supply and demand changed little from previous months.

3. Of the four transactions reported, the two involving the largest quantities are attributable to negotiations begun in previous months.

4. Buyers are continuing to exercise discretion with respect to sellers' offers. Even the few buyers having firm purchase requirements are timing their entry so as to allow ample time to examine the market.

5. Sellers active in the market have been unwilling to raise their offering prices in the face of buyers' resistance, which is partially due to the continued strength of the US dollar, particularly against European currencies.

6. Several potential sellers, including producers and users having large unneeded inventories, are awaiting the appearance of additional firm demand and higher prices.

The actions of one or two potential buyers of large quantities of material (upwards of one million pounds U_3O_8) could cause substantial price movements in October, especially if sellers offer insufficient quantities at current prices. Substantial supplies would, of course, become available at higher prices, but whether such prices will materialize largely depends on how buyers approach the market. Rapid, aggressive procurement efforts probably would lead to price firming, while a more measured approach could well leave market prices relatively unchanged.

* * *

The **Conversion Value** as of September 30, 1984 is **$1.00** per pound U in UF_6, up from $0.80.

Even though the selling of natural UF_6 to a buyer that prefers uranium oxides sometimes requires sellers to discount their offering prices somewhat, primarily by pricing the conversion services contained therein virtually at zero, at least two potential buyers of secondary market conversion services have indicated their willingness to pay approximately $1.00 per pound U as UF_6.

Active supply of secondary market conversion services for delivery within three years amounts to 2.8 million pounds U in UF_6. No active secondary market conversion demand for delivery within three years, and no secondary market conversion transactions, are reported.

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ENRICHED URANIUM AND SWUS

The Nuexco **SWU Values** as of September 30, 1984 are as follows:

1. For **DOE origin** and a tails assay of 0.30 weight-percent U_{235}:
   a. For FY85 delivery, $115 per SWU;
   b. For FY86 delivery, $20 discount from the USEC base price on delivery;
2. For **non-DOE origin:**
   a. For delivery within approximately 15 months, $90 per SWU, up $5;
   b. For delivery in calendar year 1986 (CY86), $98 per SWU.

No new secondary market SWU transactions are reported. Active near-term SWU supply on the secondary market amounts to 275,000 SWUs, while active demand amounts to 395,000 SWUs.

With this month's Report, Nuexco begins the publication of two new SWU Values, reflecting the market's shift away from 1985 and toward 1986. While there is still significant activity in the market for sales of FY85 DOE origin SWUs and CY85 non-DOE origin SWUs, some utilities have begun purchasing DOE SWUs to fill the percentage of their FY86 requirements not covered by the USEC. Buyers of non-DOE origin SWUs are also showing more interest in CY86 deliveries.

The non-DOE and FY85 SWU values are expressed as fixed prices. Typically, secondary market SWU sellers have preferred to offer enrichment services at fixed prices whenever their purchase prices have been known. Because the FY86 price will not be known until February or March of 1985, customers typically express offers for FY86 SWUs as a discount from the USEC price for FY86.

The new DOE SWU Value is referenced to *fiscal year* 1986, while the new non-DOE SWU Value is referenced to *calendar year* 1986. The three-month difference reflects the ways in which buyers of DOE SWUs and sellers of non-DOE SWUs, respectively, view the market. Nuexco also changed its reference tails assay for DOE SWUs from 0.20 weight-percent (w/o) U_{235} to 0.30 w/o U_{235}. Nuexco originally chose a reference tails assay of 0.20 w/o because it was the transaction tails assay for the holders of 3.5-year Requirements contracts (who, as buyers, dominated the secondary SWU market before the USEC was issued). However, tails assays of 0.20 w/o are no longer as prevalent as 0.30 w/o U_{235}; at present, most secondary market offers for DOE origin SWUs, especially those for FY86 delivery, are referenced to tails assays of 0.30 w/o U_{235}. In the process of converting to the USEC, many utilities have accepted assignments of excess DOE SWU commitments from other utilities. DOE's willingness to permit those buyers to vary the tails assays of the assigned enrichment services at no charge makes it more cost-effective for some of them to specify higher tails assays. Hence the choice of 0.30 w/o as the reference tails assay for DOE SWU Values.

* * *

With a perceived deadline of October 1, DOE's customers have been making strategic decisions with regard to their enrichment services requirements and conversion to the USEC. By September 28, all Japanese utilities had signed the USEC, most of them for 100-percent coverage of their enrichment requirements. In the USA, only about six utilities still intend not to convert to the USEC. In previous months, Nuexco had anticipated that DOE would have difficulty maintaining their market share in Europe. Even in Europe, however, DOE scored a relative success, particularly when Spain's ENUSA (Empresa Nacional del Uranio, S.A.), one of the major Eurodif partners, agreed to convert to the USEC.

In the process, however, DOE did lose some customers to the competition. For several customers, DOE also accepted deferrals (short-term losses) of contractual commitments in FY85 and FY86 in exchange for 100-percent coverage of their requirements as part of the negotiated conversion terms. Despite those lost SWU sales, it appears that DOE has maintained a market share that exceeds most expectations for the next five years.

Maintaining as large a market share as possible, even to the detriment of short-term revenues, appears to have been the primary objective of DOE's campaign to promote conversion to the USEC. To achieve this goal, DOE offered a lower current SWU price and, more importantly, projections of lower prices in the future. This strategy forced adjustments to DOE's accounting methods in order to establish a budget in compliance with the cost recovery rule.

Until 1974, the US government held a monopoly on sales of enrichment services to commercial nuclear power plants. Customers had had very little leverage in negotiating prices and contract terms which were subject to unilateral decisions from the US government. With the emergence of three competitors (Eurodif and Urenco in Europe; Techsnabexport in the USSR) in the mid-seventies, losses in sales became more apparent and DOE began to compare its declining market share unfavorably

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to its 100-percent market share of the early 1970s. For instance, DOE has reported that its world market share dropped from 69 percent in 1979 to 62 percent in 1984.

In support of its marketing efforts, DOE has presented itself as a non-profit organization of the US government. DOE has emphasized its greater production experience and its theoretical economy of scale. Using its own highly optimistic forecast of SWU sales, and based on the assumption that its development of new enrichment technologies will be cost-effective, DOE has projected prices well below the current SWU price ceiling. In April 1984, DOE's presentation to Congress indicated that a SWU price of $135 from 1985 through 1994 would satisfy the statutory requirement for full-cost recovery over a reasonable time period. During its recent presentations to prospective converts to the USEC, DOE has raised the prospect of SWU prices between $120 in 1987–1988 and $110 or lower in 1994. In Nuexco's opinion, DOE's published justifications are neither sufficient nor consistent enough to substantiate such projections. Even with a SWU price of $135 through 1994, if SWU sales are closer to the Nuexco estimate than that of DOE, DOE could

Table 1

DOE SALES LOSSES[1] FROM CONTRACT CANCELLATIONS[2]

Country	Reactor	Lost Sales ($M)	Replacement Supplier
Contracts Canceled:			
Federal Republic of Germany	Biblis	230	Urenco
Federal Republic of Germany	Philippsburg 2	200	Urenco
Federal Republic of Germany	Wuergassen	110	Urenco
Spain	Valdecaballeros	430	Eurodif/Techsnabexport
Spain	Lemoniz 1	280	Eurodif/Techsnabexport
Spain	Lemoniz 2	290	Eurodif/Techsnabexport
Spain	ASCO 1	280	Eurodif/Techsnabexport
Spain	ASCO 2	420	Eurodif/Techsnabexport
Spain	Almaraz 1	260	Eurodif/Techsnabexport
Spain	Almaraz 2	280	Eurodif/Techsnabexport
Spain	Cofrentes 1	260	Eurodif/Techsnabexport
Spain	Zorita 1	70	Eurodif/Techsnabexport
Spain	Garona	130	Eurodif/Techsnabexport
Sweden	OKG 3	420	Techsnabexport
Sweden	Forsmarck 3	255	Undecided
Switzerland	Beznau 2	55	Urenco
Switzerland	Leibstadt	300	Undecided
Switzerland	Goesgen	350	Undecided
USA	Seabrook 1	290	Undecided
USA	Seabrook 2	305	Undecided
	Subtotal	$5,215	
Loss of New Sales:			
South Korea	Units 9 & 10	200	Eurodif
Taiwan	Units 7 & 8	300	Eurodif
	Total Lost Sales	$5.7 Billion	

[1]Through March 1, 1984.
[2]Refers to cancellations of entire contracts, not partial terminations.

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find itself in the red by several billions of dollars rather than at a breakeven point in 1994. Prices lower than $135 would produce even higher losses.

The low-cost production capability, much needed to lower SWU prices, demands substantial revenues for its implementation. The current DOE financial condition makes it an uncertain consideration. This critical financial condition is the result of significant losses in sales experienced by DOE during a period of major capital expansion. For instance, DOE reported as of March 1, 1984 that since 1979 twenty contracts were canceled, a total amount in lost sales of about $5.7 billion. The canceled contracts are detailed in Table 1. Additional deliveries amounting to a loss in enrichment sales in excess of $2 billion were canceled as part of partial contract terminations. Nuexco's analysis indicates DOE lost business has increased by approximately ten percent in the past seven months.

What are the most important reasons for DOE's success in persuading customers to convert to the USEC in higher than anticipated percentages? DOE's projections of future market demand and of their own SWU pricing policy did not constitute a convincing argument for conversion to the USEC based on purely economic considerations; adequate supporting information was not provided. DOE also undertook a major marketing effort, but the real reasons for DOE's success lie elsewhere.

1. DOE exploited nationalism and political considerations in the USA that establish a bias toward domestic supply.

2. In the Far East, DOE obtained maximum advantage from Japanese concerns for security of supply and political considerations such as foreign trade and national security. However, these same considerations, which are not price-sensitive, will become less important as additional enrichment capabilities are developed locally as part of national programs. In a market where all enrichment suppliers will be operating well below capacity, a trend toward local enrichment would substantially reduce DOE sales. Just three utilities in Japan, for instance, take about 14 percent of the DOE production.

3. In Europe, DOE offered very liberal conversion terms, such that their decidedly price-conscious European customers found it easier than expected to accept the USEC.

With so many unknowns and so many likely obstacles, it will be very difficult for DOE to recover its costs fully by 1995. If it fails to do so, and if DOE's Japanese and European customers turn to local suppliers, the only sources of revenues that will remain to cover potentially tremendous losses will be US utilities (ratepayers) and the US government (taxpayers).

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CURRENT MARKET DATA

September 30, 1984	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$17.50**/lb. U_3O_8	5,490	955
CONVERSION VALUE	**$1.00**/lb. U in UF_6	2,825	0
SWU VALUES		275	395
DOE origin, 0.3 tails assay			
FY85 delivery	**$115**/SWU		
FY86 delivery	**$20** discount/SWU		
non-DOE origin,			
delivery within 15 months	**$90**/SWU		
non-DOE origin, CY86 delivery	**$98**/SWU		
LOAN USE CHARGE RATE	6%/annum	0	0

TRANSACTION VALUE	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
	16.55	4.3	12	5

[1]Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category. Quantities of SWUs (Separative Work Units) are not referenced to a particular origin.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
3. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
4. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
5. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the DOE SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)
Australia (dollar)	20.96	20.60	26.74	54.49	53.56	69.52
Belgium (comm. franc)	1,072	1,018	1,284	2,786	2,647	3,338
Canada (dollar)	23.05	22.71	29.59	59.92	59.03	76.92
Finland (markka)	110.06	105.87	136.29	286.14	275.23	354.31
France (franc)	162.04	154.87	192.62	421.26	402.62	500.76
FRG (mark)	53.05	50.49	63.41	137.91	131.26	164.85
Italy (lira)	32,901	31,418	38,400	85,535	81,681	99,831
Japan (yen)	4,280	4,220	5,683	11,126	10,971	14,775
Netherlands (guilder)	59.50	56.91	70.88	154.70	147.95	184.27
South Africa (rand)	29.17	27.34	26.45	75.83	71.09	68.75
Spain (peseta)	2,959	2,884	3,653	7,693	7,498	9,497
Sweden (krona)	149.83	145.11	188.09	389.52	377.25	488.99
Switzerland (franc)	43.68	41.96	51.15	113.57	109.08	132.98
UK (pound)	14.05	13.34	16.03	36.52	34.68	41.68
US (dollar)	17.50	17.50	24.00	45.50	45.50	62.39

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)
Australia (dollar)	19.82	19.31	26.35	51.53	50.19	68.51
Belgium (comm. franc)	1,013	954.04	1,265	2,635	2,480	3,290
Canada (dollar)	21.80	21.28	29.15	56.67	55.32	75.79
Finland (markka)	104.09	99.21	134.30	270.61	257.93	349.15
France (franc)	153.24	145.13	189.91	398.39	377.31	493.46
FRG (mark)	50.17	47.32	62.48	130.42	123.01	162.44
Italy (lira)	31,115	29,443	37,840	80,892	76,546	98,376
Japan (yen)	4,047	3,955	5,600	10,522	10,281	14,559
Netherlands (guilder)	56.27	53.33	69.85	146.30	138.65	181.59
South Africa (rand)	27.58	25.63	26.06	71.71	66.62	67.75
Spain (peseta)	2,798	2,703	3,600	7,275	7,026	9,358
Sweden (krona)	141.70	135.99	185.34	368.38	353.54	481.86
Switzerland (franc)	41.31	39.32	50.40	107.40	102.22	131.04
UK (pound)	13.29	12.50	15.80	34.54	32.50	41.07
US (dollar)	16.55	16.40	23.65	43.03	42.64	61.48

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on September 28, 1984.

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CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)	This Month (Sept. 30, 1984)	Last Month (August 31, 1984)	12 Months Ago (Sept. 30, 1983)
Australia (dollar)	1.20	0.94	1.11	2.64	2.08	2.46
Belgium (comm. franc)	61.24	46.54	53.50	135.00	102.60	117.96
Canada (dollar)	1.32	1.04	1.23	2.90	2.29	2.72
Finland (markka)	6.29	4.84	5.68	13.87	10.67	12.52
France (franc)	9.26	7.08	8.03	20.41	15.61	17.69
FRG (mark)	3.03	2.31	2.64	6.68	5.09	5.82
Italy (lira)	1,880	1,436	1,600	4,145	3,166	3,527
Japan (yen)	244.56	192.91	236.80	539.16	425.29	522.05
Netherlands (guilder)	3.40	2.60	2.95	7.50	5.74	6.51
South Africa (rand)	1.67	1.25	1.10	3.67	2.76	2.43
Spain (peseta)	169.09	131.84	152.21	372.78	290.66	335.56
Sweden (krona)	8.56	6.63	7.84	18.88	14.62	17.28
Switzerland (franc)	2.50	1.92	2.13	5.50	4.23	4.70
UK (pound)	0.80	0.61	0.67	1.77	1.34	1.47
US (dollar)	1.00	0.80	1.00	2.20	1.76	2.20

SWU VALUES EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU FY85 (September 30, 1984)	DOE SWU FY85 (August 31, 1984)	Non-DOE SWU delivery within 15 months (September 30, 1984)	Non-DOE SWU delivery within 15 months (August 31, 1984)
Australia (dollar)	137.72	117.72	107.78	100.06
Belgium (comm. franc)	7,042	5,817	5,511	4,945
Canada (dollar)	151.46	129.75	118.53	110.29
Finland (markka)	723.27	604.96	566.04	514.22
France (franc)	1,065	884.96	833.33	752.21
FRG (mark)	348.59	288.52	272.81	245.24
Italy (lira)	216,206	179,533	169,205	152,603
Japan (yen)	28,124	24,114	22,010	20,497
Netherlands (guilder)	391.02	325.20	306.02	276.42
South Africa (rand)	191.67	156.25	150.00	132.81
Spain (peseta)	19,445	16,480	15,218	14,008
Sweden (krona)	984.59	829.19	770.55	704.81
Switzerland (franc)	287.07	239.75	224.66	203.79
UK (pound)	92.32	76.22	72.25	64.79
US (dollar)	115.00	100.00	90.00	85.00

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on September 28, 1984.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
3122	1986-90	1,001-1,500	see remarks	Australian Producer	European Utility	Related to market price; subject to government guidelines.
3121	1986-90	301-600	see remarks	US Producer	European Trader	Partial advance payment, plus fixed price on delivery.
3115	1984	301-600	96	African Producer	European Utility	UF_6.
3114	1984	50-100	94	European Entity	US Producer	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

No secondary market enrichment transactions this month.

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URANIUM SUPPLY
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1575	500	500 per year	
1860	400	1,500 per year	
2038	1,000	1,000 per year	UF_6
2236	—	200 per year	1985-89
2263	—	500 per year	1985-90
2275	150	—	
2288	45	—	UF_6
2336	—	250 per year	
2368*	—	250 per year	1987-90
2392	35	—	UF_6
2429*	900	—	
2484	130	—	
2499	15	—	
2509	1,200	1,600	UF_6
2516*	200	—	
2538*	15	—	
2565	400	—	
2574*	500	—	UF_6
TOTAL:	5,490		
INACTIVE			
0564	—	1,000 per year	1985-90
2191	125	—	UF_6
2193	—	800 per year	1986-90
2271	—	500 per year	1984-88
2297*	—	200 per year	1986-89
2326*	—	1,000 per year	1989-91
2335*	275	—	
2389	300	—	
2473	—	500 per year	1984-90
2495	130	—	UF_6
2514	—	1,000 per year	
2553	300	—	
TOTAL:	1,130		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 1818, 2201, 2489, 2521, 2556.

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CURRENT MARKET DATA

URANIUM DEMAND
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2217	—	1,000 per year	1988-95
2419*	155	—	1985
2528	—	250 per year	1991 on
2555*	—	150 per year	1986-91
2563*	800	—	UF_6
TOTAL:	955		
INACTIVE			
1999	—	50 per year	1985-90
2244	—	350 per year	1987 on
2329*	500	—	1985
2414	—	150 per year	1987-91
2442	—	250 per year	1986 on
2457	—	350 per year	1988 on
2506*	50	—	U_3O_8 or UF_6
2507	—	300	1987-88
2542A	—	1,400	1990; UF_6e
TOTAL:	550		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

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LOAN SUPPLY AND DEMAND
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
INACTIVE			
1938	2,000	—	UF_6
2128*	700	—	
2139	2,000	—	
2483	550	—	
TOTAL:	5,250		

*New or revised since last month.
[1]Measured from the date of this Report.

No inquiries to borrow this month.

CONVERSION SUPPLY AND DEMAND
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF_6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2141	2,600	—	
2560	225	—	
TOTAL:	2,825		
INACTIVE			
2051	1,000	—	
2438	500	250	1985-87
2511	600	700	1986-90
TOTAL:	2,100		
Inquiries to Purchase:			
INACTIVE			
2420	300	—	1986
TOTAL:	300		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: 2401, 2456B.

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CURRENT MARKET DATA

SWU SUPPLY
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2100	—	100 per year	1986-87
2164	80	—	
2285	—	1,000	
2408	—	65	1986
2428	80	40	
2510*	40	50	
2513*	25	25	1986
2517*	—	150	1989
2589*	50	—	
TOTAL:	275		
INACTIVE			
2192	10	—	
2359*	180	—	
2531*	—	150	1987
2571*	—	55	1987
2580*	150	—	
2583*	50	—	
TOTAL:	390		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2550.

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SWU DEMAND
(September 30, 1984)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2443*	100	—	
2452	30	—	1985
2471	—	40 per year	1986-90
2480*	100	—	
2519	—	30 per year	1987 on
2543*	—	20	1986
2562	15	30	1986
2564*	—	100	1986
2579*	150	—	
TOTAL:	395		
INACTIVE			
2459	—	50 per year	1987 on
2500*	—	130	1987-90
2503*	—	330	1986
2512	—	15 per year	1987 on
2552	35	—	
2578*	—	150	1986
TOTAL:	35		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2449, 2454, 2479, 2542B, 2600.

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FOCUS

JAPAN'S NUCLEAR FUEL FABRICATORS

Introduction

Japan's nuclear industry has achieved essentially complete domestic capability to supply its needs for fabrication of nuclear fuel. When current expansion programs are complete, three companies will have the facilities to fabricate a combined total of approximately 1,700 short tons of UO_2 annually for BWR and PWR fuel. Japan Nuclear Fuel (JNF), Mitsubishi Nuclear Fuel (MNF) and Nuclear Fuel Industries (NFI) are producing fuel for initial cores and reloads and meeting utility delivery schedules.

Fabrication

JNF fabricates BWR fuel based on a technical license obtained from General Electric (G.E.) of the USA. Similarly, Westinghouse licenses MNF for the manufacture of PWR fuel. The two licensors actively participate in the ownership of the Japanese companies. Both G.E. and Westinghouse have representation on the respective Boards of Directors, in addition to providing a US officer in the company. During the initial phases of Japan's commercial lightwater reactor (LWR) generation program in the mid-1960s, the two US manufacturers negotiated licensing agreements with Japanese nuclear hardware makers for the basic LWR technology (Report 185). Joint ventures materialized and became the basis for today's nuclear licensing agreements. Hitachi and Toshiba, Japan's BWR vendors, collaborate with G.E. in JNF. Mitsubishi Heavy Industries (MHI), Japan's PWR supplier, is part owner of MNF with Westinghouse (Table 2).

The nuclear fuel fabrication and research activities of Furukawa Electric and Sumitomo Electric combined to form NFI in the early 1970s. NFI, which manufactures fuel for both BWRs and PWRs, was established in response to the Japanese government's and utilities' desire for an alternate domestic LWR fuel supplier. Technical agreements with Babcock and Wilcox in the USA for PWR fuel design and manufacturing expertise, and with Kraftwerk Union (KWU) in Germany for BWR technology, as well as cross-licensing with G.E. on specific BWR fuel patents, enhanced NFI capabilities. NFI's separate facilities consist of Tokai Works in the Ibaragi Prefecture for BWR fuel, and Kumatori Works in Osaka for PWR fuel.

Initial Core

Japanese utilities normally purchase the initial core for a new reactor from the supplier of the nuclear steam sup-

Table 2

JAPAN NUCLEAR FUEL MANUFACTURERS

Company	Plant Name and Location	Type of Fuel	Annual Capacity (tons UO_2 per year) Current	Projected	Ownership
Japan Nuclear Fuel (JNF)	Kurihama Works Kanagawa Prefecture	BWR	490	750	Hitachi—30% Toshiba—30% G.E.—40%
Mitsubishi Nuclear Fuel (MNF)	Tokai Works Ibaragi Prefecture	PWR	420	600-650	MHI[1]—15% Mitsubishi Metals—51% Westinghouse—34%
Nuclear Fuel Industries (NFI)	Tokai Works Ibaragi Prefecture	BWR	100	not established	Furukawa Elec.—50% Sumitomo Elec.—50%
	Kumatori Works Osaka	PWR	265		

[1]Mitsubishi Heavy Industries.

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ply system (NSSS). Hitachi and Toshiba, the BWR suppliers, perform basic core and fuel design and subcontract for fuel manufacture to JNF. The NSSS supplier, not the fuel manufacturer, provides mechanical and burnup warranties for the fuel. In a similar way, MHI subcontracts to MNF for supply of initial core PWR fuel. G.E. and Westinghouse also have participated in the supply of several reactors in Japan. Prior to the formation of JNF and MNF, fuel for those reactors came from US suppliers, but joint ventures in Japan provided initial core fabrication for subsequent projects. NFI has not supplied initial cores for LWR plants.

Reload Fuel

Utility contracting procedures for reload fuel vary depending on reactor type. For BWR reloads, the reactor supplier provides fuel and core management, while subcontracting for fuel fabrication, primarily to JNF. NFI has received only a few partial reload fuel contracts to date from original plant suppliers, usually at the plant owner's request. However, in recent years, the PWR utilities have given some reload fuel orders directly to NFI. PWR plant owners generally follow the same method and contract with MHI for reload fuel to be fabricated by MNF. While G.E. has received continuing BWR reload orders for reactors it originally supplied in Japan, Westinghouse has had only minimal direct participation in PWR reload activities.

Conversion

The conversion of enriched UF_6 to UO_2 for the manufacture of LWR fuel pellets is one area in which Japan has yet to achieve complete domestic capability. Current conversion capacity is less than 1,000 short tons UO_2 per year, well under the planned annual fuel fabrication capacity of the three manufacturers (1,700 tons UO_2). Currently, MNF has conversion capacity of 420 tons UO_2 annually, adequate for its current fuel fabrication capacity only. Neither NFI nor JNF has conversion facilities.

Japan Nuclear Fuel Conversion (JCO), established in 1979 and wholly owned by Sumitomo Metal Mining Company, has recently expanded its conversion capacity to 500 short tons UO_2 per year. JCO currently supplies all of NFI's and a portion of JNF's UO_2 conversion requirements. G.E. in the USA handles JNF's remaining needs for UO_2 conversion. JCO is evaluating plans to further expand capacity to meet expected future domestic demand.

The production of Zircaloy tubing for PWR (Sumitomo Metal Industry and Mitsubishi Metal Industry) and BWR (Kobe Steel) fuel manufacture has been sufficient for Japan's nuclear industry. Zirconium ingots for tube manufacture, however, are still imported. Mitsui Company, Ishizuka Laboratories and Nippon Mining are planning to form a joint venture to produce 1,000 short tons of elemental zirconium annually beginning in 1986. All other fuel-related components are available from established domestic suppliers, except some tubing for newer, high performance BWR fuels and miscellaneous parts that are still imported.

Because of the lack of indigenous uranium deposits, the Japanese utilities will continue to rely on overseas supply of uranium for their nuclear fuel needs. Nuexco estimates that current inventory and deliveries under long-term contracts are adequate for needs through the late 1990s. Currently, Japan is dependent on foreign supply of uranium enrichment services, predominantly from the USDOE and, to a small extent, from Eurodif. Although overseas enrichment capacity is adequate to supply Japanese utilities' requirements through the year 2000, Japan nevertheless is proceeding with plans for a domestic enrichment facility. (See Report 189 and Report 193.) Latest plans call for an enrichment plant that could produce 1.5 million SWUs per year by 1997, a target that would cover approximately 20 percent of Japan's annual needs. Security of enrichment supply, rather than strict economic factors, appears to be the impetus behind the development effort.

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RECENT DEVELOPMENTS

AUSTRALIA

The Australian government has enforced its ban on uranium exports to France by refusing to grant Queensland Mines, Ltd. (QML) an export license for next month's delivery. Although the ban was officially declared in early 1983 and re-affirmed by the Australian Labor Party (ALP) national conference last July, it lingered ineffectually until new shipments were due under the QML contract with Electricite de France (EdF). The contract was negotiated in 1981 and calls for 6.8 million pounds U_3O_8 to be delivered between 1982 and 1988.

Hoping to placate domestic opposition to its uranium policy, the ALP enacted the ban as a political protest against French weapons tests in the Pacific Ocean. However, the wide supply base for uranium in France indicates that the ban on Australian material will prove rather futile. Furthermore, the government's recent parliamentary fact-finding mission discovered that the French government enjoys widespread domestic support for its nuclear policy, including its weapons program. Therefore, the pattern of weapons tests is not likely to change in the immediate future.

If effective, the uranium ban could become very costly for Australia as a trading nation. While the ALP had gained the support of the Australian business community, political actions that damage international trade could erode that support. QML faces customer and revenue losses, and the ban similarly affects Western Mining, whose prospects of achieving baseload tonnage for Roxby Downs without sales to France are remote.

* * *

After the takeover of Getty Oil by Texaco, Inc., its 35 percent stake in Pancontinental's Jabiluka deposit is for sale together with Getty's other mining interests. BHP, Australia's largest company, is investigating the purchase of Getty Mining Company from Texaco. However, BHP is not interested in acquiring the Jabiluka mine. BHP interests have not included uranium because of concerns that anti-uranium sentiments could damage the credibility and effectiveness of its other operations.

JAPAN

Report 186 (February 1984) presented an annual review of Japan's commercial nuclear generation program. The Ministry of International Trade and Industry (MITI), the government agency responsible for long-term economic planning, had established revised goals for nuclear electricity generating capacity to be in operation by:

1990—34,000 MWe;
1995—48,000 MWe;
2000—62,000 MWe.

Recently, a select MITI Advisory Committee for Energy reviewed those objectives, and, citing the need to emphasize nuclear power as a long-term alternative to oil-fired generation facilities, confirmed the desirability of MITI's goals for Japan's private utility sector. It also confirmed that Japanese utilities' current inventories, combined with deliveries scheduled under long-term contracts, totaled approximately 400 million pounds U_3O_8 equivalent and were adequate to meet cumulative needs through 1995. It concluded, however, that the utilities would require an additional 120 million pounds U_3O_8 equivalent to meet the power generation goals for the year 2000. The committee further suggested that at least half of the remaining requirements be secured via the participation of Japanese entities in overseas development projects, with the remainder supplied by long-term contracting from overseas producers.

The committee report could lead to speculation that the utilities might initiate significant uranium procurement efforts over the next several years, primarily based on their demonstrated concern for security of supply. In Nuexco's evaluation, however, the MITI goals for 1995 and 2000 are overly optimistic. Even with the ability demonstrated by Japanese utilities in recent years to license and build nuclear power plants on schedule, it is doubtful that the MITI goals for 1995 and 2000 will be realized. To achieve 48,000 MWe installed capacity by 1995 would require the addition of 14,000 MWe to the 1990 MITI goal of 34,000 MWe, a rate of 2,800 MWe per year over a five-year period. With current construction progress, however, Nuexco expects an average annual capacity addition of 1,700 MWe. Tables 3 and 4 present a current update on Japanese nuclear plants operating, under construction or in licensing. The latter category includes active plant projects with commercial operation dates in the first half of the 1990s. In recent months, several plants under construction, or in licensing with 1990–1995 operation targets, have been delayed one to two years.

In the next few years, sites will be confirmed for an additional five to six plants scheduled for commercial operation between 1992 and 1995. Moreover, long-term con-

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tracts with deliveries continuing well into the 1990s indicate that most Japanese utility uranium inventories will continue to grow beyond current levels. However, three factors support Nuexco's opinion that present long-term contract deliveries of U_3O_8 will be adequate for this century.

1. Utilities must address the impact of the DOE's USEC contract on their current uranium inventories. Conversions to the USEC will reduce needs for future deliveries.

2. A MITI goal of 39,000–41,000 MWe nuclear capacity installed by 1995, and correspondingly reduced requirements, would be more realistic.

3. It is more difficult to project installed capacity for the year 2000, but significant reductions in MITI's targets and their associated requirements are likely.

Table 3

JAPANESE NUCLEAR POWER UNITS
UNDER CONSTRUCTION AND UNDERGOING LICENSING

Unit	Utility	Capacity (MWe net)	Type	Estimated Commercial Operation
Under Construction				
Takahama 3	Kansai EPC[1]	870	PWR	Feb 1985
Fukushima II-3	Tokyo EPC	1100	BWR	Jul 1985
Takahama 4	Kansai EPC	870	PWR	Aug 1985
Kashiwazaki 1	Tokyo EPC	1100	BWR	Oct 1985
Sendai 2	Kyushu EPC	890	PWR	Mar 1986
Tsuruga 2	JAPC[2]	1160	PWR	Jun 1987
Hamaoka 3	Chubu EPC	1100	BWR	Sep 1987
Fukushima II-4	Tokyo EPC	1100	BWR	Sep 1987
Shimane 2	Chugoku EPC	820	BWR	Sep 1988
Kyowa Tomari 1	Hokkaido EPC	579	PWR	Jun 1989
Kashiwazaki 5	Tokyo EPC	1100	BWR	Apr 1990
Kashiwazaki 2	Tokyo EPC	1100	BWR	Oct 1990
Kyowa Tomari 2	Hokkaido EPC	579	PWR	Jun 1991
Undergoing Licensing				
Ikata 3	Shikoku EPC	890	PWR	Oct 1990
Genkai 3	Kyushu EPC	1180	PWR	Mar 1993
Maki 1	Tohoku EPC	825	BWR	Mar 1994
Genkai 4	Kyushu EPC	1180	PWR	Mar 1994
TOTAL MWe		16,443		

[1]EPC = Electric Power Company.
[2]JAPC = Japan Atomic Power Company.

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RECENT DEVELOPMENTS

Table 4

COMMERCIALLY OPERATING NUCLEAR POWER PLANTS IN JAPAN

Unit	Utility	Capacity (MWe net)	Type	Commercial Operation
Tokai 1	JAPC[1]	166	GCR	Jul 1966
Tsuruga 1	JAPC	357	BWR	Mar 1970
Mihama 1	Kansai EPC[2]	340	PWR	Nov 1970
Fukushima I-1	Tokyo EPC	460	BWR	Mar 1971
Mihama 2	Kansai EPC	500	PWR	Jul 1972
Shimane 1	Chugoku EPC	460	BWR	Mar 1974
Fukushima I-2	Tokyo EPC	784	BWR	Jul 1974
Takahama 1	Kansai EPC	826	PWR	Nov 1974
Genkai 1	Kyushu EPC	559	PWR	Oct 1975
Takahama 2	Kansai EPC	826	PWR	Nov 1975
Fukushima I-3	Tokyo EPC	784	BWR	Mar 1976
Hamaoka 1	Chubu EPC	540	BWR	Mar 1976
Mihama 3	Kansai EPC	826	PWR	Dec 1976
Ikata 1	Shikoku EPC	566	PWR	Sep 1977
Fukushima I-5	Tokyo EPC	784	BWR	Apr 1978
Fukushima I-4	Tokyo EPC	784	BWR	Oct 1978
Tokai 2	JAPC	1100	BWR	Nov 1978
Hamaoka 2	Chubu EPC	840	BWR	Nov 1978
Ohi 1	Kansai EPC	1175	PWR	Mar 1979
Fukushima I-6	Tokyo EPC	1100	BWR	Oct 1979
Ohi 2	Kansai EPC	1175	PWR	Dec 1979
Genkai 2	Kyushu EPC	559	PWR	Mar 1981
Ikata 2	Shikoku EPC	566	PWR	Mar 1982
Fukushima II-1	Tokyo EPC	1100	BWR	Apr 1982
Fukushima II-2	Tokyo EPC	1100	BWR	Feb 1984
Onagawa 1	Tohoku EPC	524	BWR	Jun 1984
Sendai 1	Kyushu EPC	890	PWR	Jul 1984
TOTAL MWe		19,691		

[1]JAPC = Japan Atomic Power Company.
[2]EPC = Electric Power Company.

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SWITZERLAND

In a popular vote held September 23, the Swiss public soundly repudiated two initiatives designed to curtail the future use of nuclear power. While the referendum attracted only 41 percent (1.7 million) of eligible Swiss voters, the nation's vocal anti-nuclear minority turned out in full force. Thus, the rejection of the initiatives was a solid victory for the Swiss utilities. That was particularly true for Kernkraftwerk Kaiseraugst AG (KWK), because the approval process for construction of its long-delayed nuclear unit had been postponed until the results of the initiatives were known. Currently, four units are in commercial operation in Switzerland, while one unit (Leibstadt) probably will achieve that status in the coming weeks (Table 5).

One of the initiatives, proposing a "future without atomic power plants," was rejected by 55 percent of the voters. The other initiative, calling for a secure supply of energy, greater conservation, and the use of "environmentally friendly" energy sources, was rejected by 54 percent. The latter initiative, if accepted, would have imposed a moratorium of indefinite length on the construction of any power plant having a capacity of more than 35 Megawatts.

A majority of voters rejected the initiatives in fifteen of Switzerland's twenty cantons and in four of its six half-cantons. Notably, all of the five cantons that approved the measures had voting turnouts below 35 percent, and all are located in the French and Italian speaking parts of the country, which are also the least industrialized and the farthest from existing nuclear units. (Two majority French-speaking cantons, Fribourg and Valais, rejected the initiatives decisively.) The two populous half-cantons of Basel, which is located 13 kilometers from the Kaiseraugst site on the Rhine River, were the only regions that voted overwhelmingly in favor of the initiatives.

The utilities and the government mounted a formidable campaign against the initiatives, stressing the positive aspects of nuclear power and the need for the country to preserve its options for future electricity requirements. Nevertheless, the utilities had not been optimistic about the outcome, and they reacted to the results with great satisfaction. Proponents of the initiatives had been collecting signatures and campaigning for more than two years. In recent months, their position had been weakened somewhat by the controversy in central Europe over acid rain, a byproduct of coal and oil combustion, both of which would be increased if the use of nuclear energy were curtailed. The nuclear opponents tried to link the dying forest problem with radiation from nuclear power plants, but met with little success.

Kernkraftwerk Kaiseraugst (KWK), more than a decade behind its original schedule for the Kaiseraugst unit, now must await a vote in the lower house (Nationalrat) of the Swiss Parliament before starting the procedure for obtaining a nuclear plant construction permit. The vote probably will take place in the spring of 1985. Switzerland's Federal Council (Bundesrat) authorized the unit in October 1981, and the upper house (Staenderat) ratified that decision in February 1983. In November 1983, a committee for the Nationalrat recommended full parliamentary approval. If the Nationalrat does grant approval, the process of obtaining a construction permit will take approximately three years. A number of design issues will be debated, including the problem of cooling towers, which the government at one time promoted in place of river cooling, but more recently intimated it favors as merely a back-up to river cooling at times of low flow or high water temperature. If construction begins in 1988, the unit could be in commercial service by 1994. If and when the path is cleared for Kaiseraugst, Kernkraftwerk Graben AG might start the approval process for construction of its Graben unit, originally scheduled for service in 1979.

Table 5

NUCLEAR POWER UNITS IN SWITZERLAND

Unit				
Operating	**Utility**	**MWe**	**Type**	**COD[1]**
Beznau 1	NOK[2]	350	PWR	Dec 1969
Beznau 2	NOK	350	PWR	Mar 1972
Muehleberg	BKW[3]	320	BWR	Oct 1972
Goesgen	KKG[4]	920	PWR	Nov 1979
Leibstadt	KKL[5]	925	BWR	Oct 1984
Planned				
Kaiseraugst	KWK[6]	925	BWR	1993
Graben	KWG[7]	1,140	BWR	indefinite

[1]Actual or expected Commercial Operation Date.
[2]NOK = Nordostschweizerische Kraftwerk AG.
[3]BKW = Bernische Kraftwerk AG.
[4]KKG = Kernkraftwerk Goesgen-Daeniken AG.
[5]KKL = Kernkraftwerk Leibstadt AG.
[6]KWK = Kernkraftwerk Kaiseraugst AG.
[7]KWG = Kernkraftwerk Graben AG.

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RECENT DEVELOPMENTS

UNITED STATES

Intercontinental Energy Corporation (IEC) announced in September that its acquisition of the Lamprecht uranium mine (in situ leach project) from Westinghouse has been approved by the Texas regulatory authorities and the transfer is complete. IEC announced the original acquisition agreement on October 20, 1983, but the property transfer had been delayed by Texas regulatory authorities until September 1984. The mine is immediately adjacent to IEC's Zamzow in situ leach uranium mine in Three Rivers, Texas.

In exchange for IEC's agreement to take title to the facilities and remaining uranium resources, Westinghouse paid IEC $600,000 in cash and also purchased an annuity which will pay a trustee acceptable to regulatory authorities ten annual installments of $1.2 million starting in 1990. The trustee will use these funds to reimburse IEC for clean-up costs of the property when mining operations cease. The trustee will pay any remaining funds to IEC. By Nuexco's estimate, an annuity of the type described could be purchased currently for approximately $4 million. Thus, the total cost to Westinghouse of the property transfer comes to $4–5 million in today's dollars.

Wyoming Mineral Corporation, a Westinghouse subsidiary, owned and operated the Lamprecht mine and suspended production from it and three other uranium operations in 1981. Nuexco estimates that the in situ leach mine contains 3 to 4 million pounds U_3O_8 at a grade of 0.05 percent. The ion exchange mill, with a production capacity of 500,000 pounds U_3O_8 per year, began recovery in 1975 and was shut down in 1981. IEC has been acquiring leases in the vicinity of the Lamprecht site, which could prolong uranium operations.

* * *

Shelby Brewer resigned from his post as assistant secretary for nuclear energy in the Department of Energy to become vice-president of operations of the Nuclear Power Systems Division of Combustion Engineering, Inc. (CE). Brewer submitted his resignation on August 22, effective September 1, at which time he assumed his new position. On January 1, 1985, he is scheduled to succeed the retiring John West as senior vice-president of the same division at CE. Although Brewer has attracted Congressional criticism over the allocation of funding for the promotion of nuclear power, DOE reports that Brewer simply received a better offer from CE. DOE has yet to announce a replacement, but Anthony Buhl reportedly is in line to succeed Brewer. Buhl is a vice-president of Technology for Energy Corporation (TEC) in Knoxville, Tennessee, and has been active in the Industry Degraded Core (IDCOR) research program.

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URANIUM IN THE USSR

Introduction

The Soviet Union hosted the 27th International Geological Congress (IGC) August 4 through August 14, 1984. More than 6000 geologists from 104 countries attended the meeting, which presented 3,200 technical papers covering every aspect of geology. The uranium portion included 50 papers, primarily on uranium deposits in sandstone and metamorphic rocks, presented to about 300 Congress members.

The IGC sponsored almost 400 geology field trips, the most noteworthy of which was a five-day trip to the Krivoi Rog iron uranium district in the south-central Ukraine. The trip's primary objective was the promotion of scientific dialogue between the Soviet scientists and their guests. A lecture on the Krivoi Rog iron ore basin preceded the excursion, and was followed by visits to two open pit iron mines and the underground Novaya uranium mine in Zholtye Vody. The excursion continued northward to Kiev to visit the Metallogeny Department of the Ukraine Academy of Sciences and the Institute of Geochemistry and Physics of Minerals.

Zholtye Vody Uranium Deposit

The Zheltorechenskoye uranium deposit at Zholtye Vody is located in the northern Krivoi Rog iron district in the Dnepropetrovsk Province (Figure 1). It is one of four known uranium districts in the western USSR. All known uranium mineralization in the Krivoi Rog district is associated with the Iron Formation. Two deposits have been mined. The Pervomaiskoye deposit at Terny was mined out by 1969 using open pit techniques. The deposit at Zholtye Vody, discovered later than Terny, is now being mined by underground methods.

Discovery and Development

Rich iron ores were discovered in the Krivbas (the Krivoi Rog Basin) in 1781. Later exploration indicated high-grade mineralization (46 percent to 70 percent Fe) in an area two to seven kilometers (km) wide and more than 100 km long. The first commercial recovery operation began in 1875, and the district developed rapidly into one of the largest iron-producing areas in the world. More than 80 percent of the iron produced in the USSR comes from the Krivbas.

When uranium was first discovered in the Krivbas is uncertain; however, the Zholtye Vody deposit was discovered in 1946. Uranium mineralization is known to occur in the Iron Formation as irregular lenticular and stratiform bodies in an area nine km long and 0.5 to 2.0 km wide. The Iron Formation hosting the uranium was discovered in 1895 and mined by open pit methods from 1898 through 1933, and by underground methods from then until uranium was encountered in the iron ore. Development of the uranium deposit began in 1949 or 1950, initial production began in 1951, and the Novaya mine has operated since then.

The mine is developed to a depth of 1,475 meters. Downward drilling from that level indicates continuous ore reserves exist at least 100 meters deeper, so it is likely that mining depths eventually will increase.

Ore Reserve and Recovery Rate

The initial ore reserve estimate of the Zholtye Vody deposit has not been released. However, Nuexco estimates unmined reserves at 15 to 20 million pounds U_3O_8. The ore occurs in multi-bodies at different elevations throughout the mine. Stratigraphy, lithology and structure controlled the placement of orebodies. Orebody dimensions vary greatly by length, thickness and vertical extent. The bodies tend to parallel the controlling structure or cut diagonally across it where influenced by fracturing and faulting. Stratiform deposits, which parallel the structure, are the largest and most important; breccia and vein-filled bodies may parallel the structure, but more commonly are diagonal to it. Nuexco estimates the in-place ore grade of remaining ore reserves at 0.12 to 0.15 percent U_3O_8. However, it is common to encounter zones of high-grade ore that may exceed 1.00 percent U_3O_8.

Uranium concentrate is produced at a mill near Zholtye Vody. Its design capacity is approximately 500,000 metric tons of ore per year. Based on reported mill capacity and other factors, Nuexco estimates remaining mine life at 10 to 15 years. Production during the early years amounted to approximately 700 metric tons of uranium (MTU) annually; today, it probably is less due to ore grade. The mill also processed ore from the Terny mine until it closed in 1969.

Mineralization

The chief uranium ore minerals in the deposit are pitchblende and uraninite. Other minerals less common in occurrence but important to total uranium production are brannerite, coffenite and uranium silicates of the nenud-

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Figure 1

WESTERN U.S.S.R.

kevite group (calcium-magnesium silicates with trace rare earths in which the uranium content varies from 20 percent to 55 percent). Uranium mineralization is associated with complex hypogene metamorphosed rock and related hydrothermal alteration. The iron ore formations of Lower Proterozoic are closely related to younger uranium mineralization. The relationship is compounded by complex metasomatism (a replacement process) in ferro-carbonate rocks and intensely altered albitites, magnetite, commingtonite-biotite and quartzite schist.

Uraninite, pitchblende and brannerite show concentration in the albitites; the minerals also formed as small clusters in the magnetites and commingtonites. The main minerals in the ferro-carbonates and quartzite schists are uraninite and pitchblende, which developed as veins in fractures and along structural zones. Coffenite and uraninite are common as fissure filling material in the carbonate rock, where it is closely associated with miscellaneous ferrous and sulfide mineralization.

Multi-staged metasomatism complicated the mineralizing process. As a result of granitic intrusions and regional structural deformation, repeated rock alteration and zonal development of the mineral suite are common, especially in fractures, breccia zones and along structural planes. The source of uranium mineralization is older conglomerates and arkoses[1] underlying the iron ore–bearing formations. The uranium content of the older rocks is known to be abnormally high throughout the northern part of the Krivbas. The movement of uranium into the Iron Formation is due to remobilization during metasomatic processes.

Geology

Situated in the central part of the Ukrainian crystalline shield, the Krivbas is characterized by Archean and Proterozoic crystalline rocks overlain by Cenozoic formations. The Archean comprises a series of granitic and metamorphic rocks that developed approximately 3500 to 2800 million years ago. The Proterozoic series consists of highly metamorphosed rocks such as gneiss, schist, metasandstone and metaconglomerate, dolomite and ferruginous silicate rocks. The age of the Proterozoic series is approximately 2700 to 1800 million years. (The age of the uranium mineralization is approximately 1700 to 900 million years.)

The iron ore–bearing sequence is represented by the highly metamorphosed Krivorozhskaya formation sequence of Lower Proterozoic age. The Krivorozhskaya is broken down into an Upper, Middle and Lower sequence which in turn is subdivided into five formations. These formations are described as follows:

1. **Upper Series**—The Gleevatskaya Formation, composed of metasandstone, biotite schists and dolomites. The formation contains low-grade iron ore.
2. **Middle Series**—The Gdantsevskaya Formation, consisting of quartz-mica/chlorite, graphite schist, metasandstone, carbonates and ferruginous quartzites. Important high-grade iron and uranium deposits occur at the contact with the Gleevatskaya series.
3. The Saksaganskaya Formation, made up of 14 alternating units of ferruginous quartzites and schists. The ferruginous rock includes banded magnetite, hermatite-silicate, albitites and martite. It contains uranium in addition to the largest percentage of high-grade iron ore formations in the Krivbas. It is in unconformable contact with the underlying formation.
4. **Lower Series**—The Skelevatskaya Formation, composed of carbonate talc, metasandstone, arkoses, schists and metaconglomerate in the lower part. It is in unconformable contact with the underlying formation.
5. The basal unit, or Novokrivorozhskaya Formation, made up of quartz-biotite schists, metasandstones, quartzites and tuffaceous shales. It is in unconformable contact with Archean rocks.

The metamorphic rocks of the Krivorozhskaya series form a very complex fold structure striking northwest-southeast. The general structure is called the Krivoi Rog synclinorium, consisting of a broad syncline with complex internal synclinal and anticlinal folding. The western limb of the synclinorium has been cut off by thrust faulting and the main iron ore sequence remains well below the surface. The east limb is displaced by faulting, but retains the original continuity and can be found at or near the surface throughout portions of the strike length of the main structure.

The Zholtye Vody deposit is confined to a narrow isoclinal syncline, the east and west limbs of which are almost vertical. The rock formations of the central portion belong to the Krivorozhskaya series. Figure 2 is a generalized vertical section of the ore-bearing structure. The syncline is broken into large blocks by faulting parallel to the strike and diagonally across it. Metasomatic products of rock and ore forming stages characterize each block. The structural position and nature of uranium orebodies were controlled primarily by metasomatism and recrystallization.

[1]Ya. N. Belevtsev, et al., 1981.

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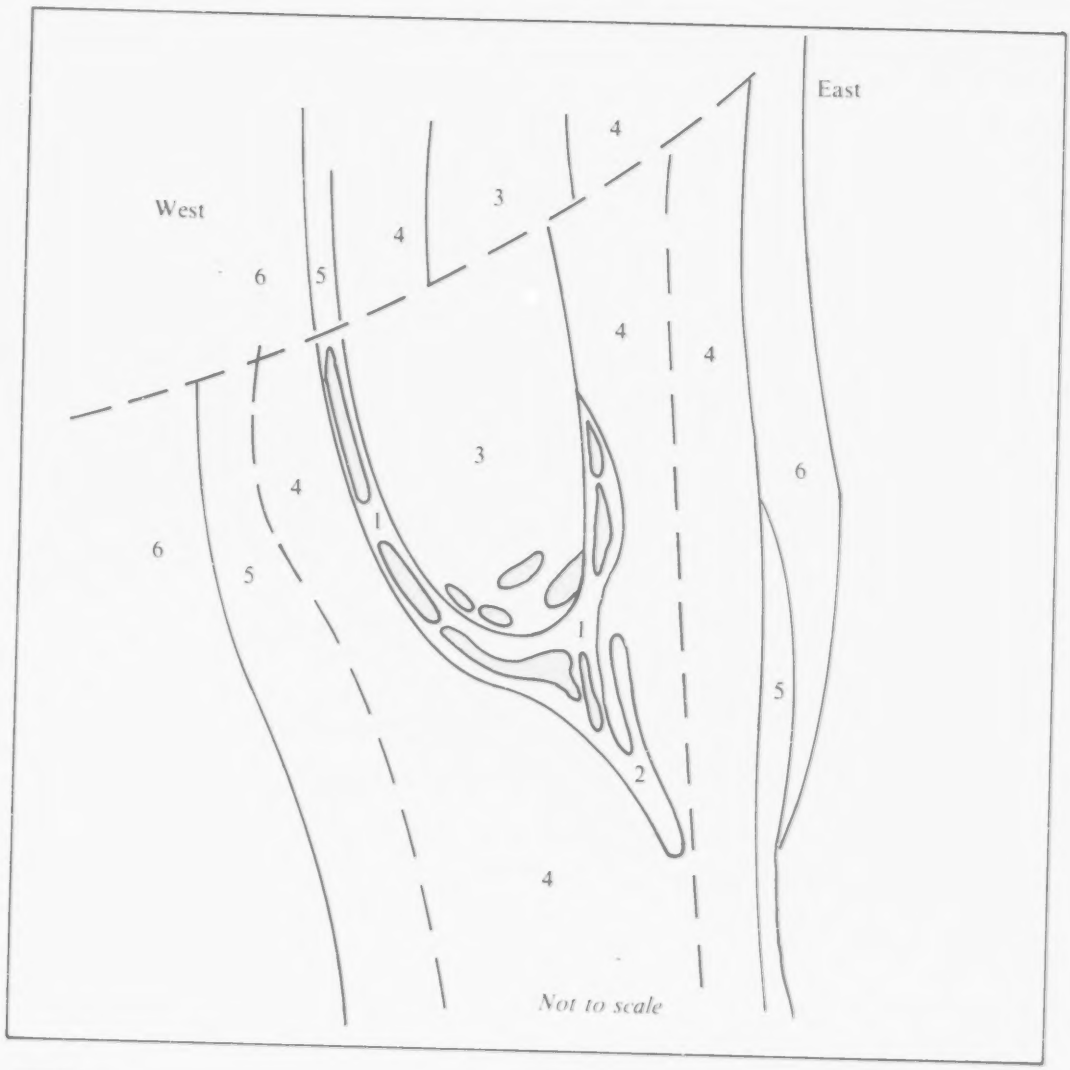

Figure 2. Generalized vertical section through the Krivoi Rog synclinorium of the Zholtye Vody uranium deposit showing the structural relationship of uranium ore bodies.

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EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated

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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	**17.50**			

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30 60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	**16.55**			

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	**1.00**			

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates[2] (1976=100)
1983 Avg.	401.2	181.8
Jun 1983	415.6	181.0
Jul 1983	408.3	180.7
Aug 1983	403.0	180.7
Sep 1983	402.9	180.6
Oct 1983	397.5	188.3
Nov 1983	395.5	188.3
Dec 1983	399.2	188.1
Jan 1984	399.1	188.3
Feb 1984	402.4	188.2
Mar 1984	403.8	188.0
Apr 1984	404.1	195.8R
May 1984	403.7R	196.6R
Jun 1984	404.8	196.6P
Jul 1984	408.3	—

P = Preliminary R = Revised since last month

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (C$)[2]					
		Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1983 Avg.	298.8	—	14.69	14.30	—	—	11.17
Jul 1983	300.4	16.48	14.35	13.93	11.70	9.83	11.04
Aug 1983	301.3	16.93	14.36	13.89	11.82	10.08	11.19
Sep 1983	301.1	17.66	14.90	14.41	11.99	10.32	11.29
Oct 1983	301.6	17.73	15.27	14.65	11.76	10.03	11.30
Nov 1983	301.8	17.82	15.29	14.67	11.78	10.62	11.38
Dec 1983	302.9	17.84	15.11	14.66	11.86	10.60	11.51
Jan 1984	305.4	17.74	15.27	14.74	11.91	10.84	11.69
Feb 1984	306.6	17.78	15.59	14.90	12.04	10.82	11.51
Mar 1984	308.7	18.05	15.52	14.82	12.14	10.84	11.58
Apr 1984	310.5R	18.06	15.83	15.10	11.96	10.34	11.63
May 1984	310.6R	18.48	15.64	15.06	12.11	10.16	11.65
Jun 1984	311.0R	18.08R	15.48R	14.80R	12.38R	10.40R	11.66R
Jul 1984	312.5R	17.43P	15.42P	14.85P	12.52P	10.18P	11.78P
Aug 1984	312.2P	—	—	—	—	—	—

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1975=100)[4]	Producer Price Index All Groups[5] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
Jul 1983	—	—	262.5	273.7	704,202	314,566
Aug 1983	—	—	265.6	278.9	698,984	311,789
Sep 1983	52.92	117.4	267.3	279.4	696,435	312,264
Oct 1983	—	—	270.0	281.0	693,225	311,418
Nov 1983	—	—	271.4	281.6	688,459	317,485
Dec 1983	53.70	119.6	273.2	283.7	690,750	333,595
Jan 1984	—	—	274.7	283.3	689,807	326,619
Feb 1984	—	—	278.4	286.5	702,553	335,906
Mar 1984	55.30	123.1	281.9	288.0	715,628	342,332
Apr 1984	—	—	286.1	290.2	712,963	327,550
May 1984	—	—	288.3	292.6	710,040	327,937
Jun 1984	56.95	126.2	291.2	295.3R	717,009	347,121
Jul 1984	—	—	295.1	296.0	—	—
Aug 1984	—	—	297.0	—	—	—

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
Jun 1983	315.3	302.4	298.1	214.55	12.55	13.37	10.52	8.63
Jul 1983	316.5	303.2	299.3	—	12.59	13.56	10.59	8.67
Aug 1983	317.3	304.7	300.3	—	12.54	13.46	10.62	8.62
Sep 1983	317.1	305.3	301.8	216.44	12.62	13.46	10.70	8.73
Oct 1983	318.5	306.0	302.6	—	12.67	13.55	10.79	8.71
Nov 1983	318.3	305.5	303.1	—	12.64	13.56	10.86	8.77
Dec 1983	318.4	306.1	303.5	218.53	12.75	13.33	10.90	8.84
Jan 1984	319.1	308.0	305.2	—	12.67	13.38	10.91	8.88
Feb 1984	320.6	308.9	306.6	—	12.81	13.34	10.90	8.86
Mar 1984	321.9	311.0	307.3	220.58	12.85	13.33	10.95	8.88
Apr 1984	322.5	311.4	308.8	—	12.91R	13.30R	10.97	8.89
May 1984	323.3	311.7	309.7	—	12.99	13.37	11.02	8.89
Jun 1984	323.9	311.4	310.7	222.40R	12.96R	13.40R	11.03R	8.91
Jul 1984	324.0	312.0	311.7	—	13.05P	13.36P	11.10R	8.95R
Aug 1984	323.5	310.9	313.0	—	—	—	11.10P	8.99P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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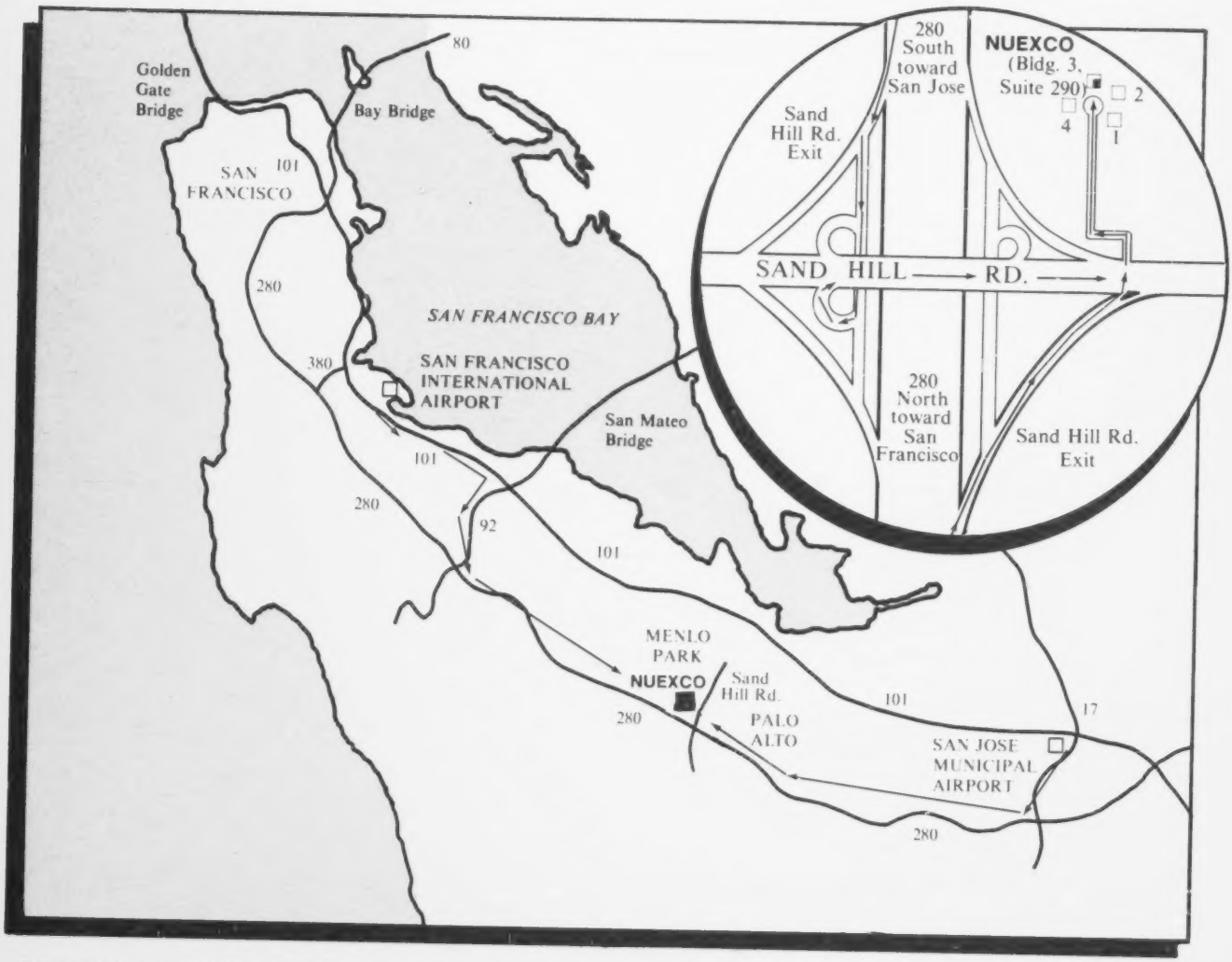

DIRECTIONS TO NUEXCO'S CORPORATE OFFICES

From San Francisco Airport:

1. Take U.S. 101 south towards San Jose.
2. Continue on U.S. 101 seven miles to Route 92 exit.
3. Take Route 92 west towards Half Moon Bay.
4. Continue on Route 92 five miles to Interstate 280 exit.
5. Take Interstate 280 south towards San Jose.
6. Continue on Interstate 280 ten miles to Sand Hill Road exit.
7. Take Sand Hill Road east towards Menlo Park (go under Sand Hill Road overpass, circle 270° to cross Interstate 80 on overpass heading east).
8. Turn left at first traffic light.
9. After turning left, take second left and follow signs for 3000 Sand Hill Road.
10. We are in Building 3, Suite 290, on the second floor.

From San Jose Airport:

1. Take Highway 17 south towards Santa Cruz.
2. Continue on Highway 17 five miles to Interstate 280 exit.
3. Take Interstate 280 north towards San Francisco.
4. Continue on Interstate 280 six miles to Sand Hill Road exit.
5. Take Sand Hill Road exit.
6. Proceed through both sets of traffic lights.
7. Take first left after second traffic light and follow signs for 3000 Sand Hill Road.
8. We are in Building 3, Suite 290, on the second floor.

Note: Distances are approximate.

HOTELS

Hilton Inn, San Francisco Airport, (415) 589-0770.
Hyatt House, 1740 North 1st Street, San Jose, (408) 298-0300
Holiday Inn-Palo Alto, 625 El Camino Real, Palo Alto, (415) 328-2800
Rickey's Hyatt House, 4219 El Camino Real, Palo Alto, (415) 493-8000
Fairmont Hotel, 950 Mason Street, San Francisco, (415) 772-5000

RESTAURANTS

L'Auberge, 2826 El Camino Real, Redwood City, (415) 365-3735 or (415) 365-9623
Dal Baffo European Cuisine, 878 Santa Cruz Avenue, Menlo Park, (415) 325-1588
Velvet Turtle, 325 Sharon Park Drive, Menlo Park, (415) 854-3813
Ming's of Palo Alto (Chinese), 1700 Embarcadero Road, Palo Alto, (415) 327-0771
Hugo's Market Restaurant (at Hyatt), 4219 El Camino Real, Palo Alto, (415) 493-8000

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